AUTOMATIC WATER LEVEL MONITORING INTEGRATED WITH IoT THROUGH SMARTPHONE

Compiled as one of the requirements of completing the Undergraduate Program at the Department of Electrical Engineering Faculty of Engineering

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APPROVAL

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SCIENTIFIC PUBLICATION

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On 15, July 2019
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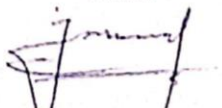

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Abstrak

Tandon air merupakan suatu alat yang digunakan untuk mengumpulkan atau penampungan air ,baik yang berasal dari PDAM (perusahaan daerah air minum), sumur ,sumber mata air,air hujan,dan lain-lain.dengan tersedianya tempat penampung air ,maka dapat dikatakan bahwa persediaan air akan selalu aman terkendali.artinya jika suatu saat tiba-tiba sumber air tidak berjalan semestinya ,akan tetap mempunyai cadangan air yang dapat digunakan .namun pengisian tanki air di masyarakat masih menggunakan system manual dalam kontrol dan tidak dapat memonitoring tinggi air di dalam tanki. Untuk itu pada tugas akhir ini di rancang suatu alat monitoring ketinggian air yang dapat memberitahu pengguna dalam ketinggian air di tanki jika air sudah penuh.serta dapat mengisi air secara otomatis . alat ini mengunakan sensor Ultrasonic (HC-SR04) sebagai sensor ketinggian air karena dinilai memiliki gelombang ultrasonic yang memancarkan dan memantulkan ke air ,hasil dari pancaran dan pantulan gelombang tersebut dapat dihitung ketinggian air. Selain itu menggunakan Wemos D1 R2 dan aplikasi Blynk yang akan memberikan informasi nilai ketinggian air dan dapat memonitoring ketinggian air ditanki melalui aplikasi Blynk di smartphone. Diharapkan penelitian ini dapat memudahkan dan mengefisian waktu dalam proses monitoring serta pengisian air.

Kata Kunci: Aplikasi Blynk, Otomatis, Sensor Ultrasonic (HC-SR04), Wemos D1 R2

Abstract

The water tank is a tool used to collect or hold water, both from wells, springs, PDAM, rainwater, etc. with the availability of water reservoirs, it can be said that the water supply will always safe control. means if one day a water source does not run properly, it will still have water reserves that can be used. However, filling the water tank in the community still requires a manual system in control and cannot monitor the water level in the tank. Therefore, in this final project a water level monitoring tool is designed that can inform the user in the water level in the tank if the water is full. And it can automatically fill water. This tool uses an Ultrasonic sensor (HC-SR04) as a water level sensor because it is considered to have ultrasonic waves that emit and reflect into the water, the results of the emission and reflection of the waves can be calculated as high as water. In addition, using WEMOS D1 R2 and the Blynk application that will provide information on water level values and can monitor water levels in the tank through the Blynk application on the smartphone. Hopefully, this research can help people who use water tanks, can facilitate and streamline time in the process of monitoring and filling water.

Keywords: Automatic , Blynk Application, Sensor Ultrasonic(HC-SR04) , Wemos D1 R2

1. INTRODUCTION

Water is one of the most basic needs for living things including humans. what happens if one day the local water company (PDAM) in the urban area dies instantly? Of course, many people in the city are starting to panic. To overcome this problem, many people in urban areas buy water tanks to collect water from the PDAM both at work and at home. the water reservoir is generally placed at an altitude that is sufficient to be able to flow to the tub in the toilet or shower. Water filling from the PDAM to the water reservoir requires a short time, people have to wait patiently until the water is full so as not to overflow. Because it needs a tool that can automatically regulate water filling. Automatic is automatic by working alone, by itself. (Large Indonesian dictionary).

To regulate the availability of water on a reservoir, a prototype of an automatic water level regulator is controlled by a microcontroller. And the need for monitoring of water tanks by internet-connected smartphones. Today's smartphone usage is very dominating human work and can defeat human computing such as controlling electronic equipment remotely using internet media, internet of things allows users to manage and optimize electronics and electrical equipment using the internet. IoT (Internet of thing) is where objects around can communicate with each other through internet networks.

1.1 Problem Formulation

Base on problems, the author will carry out activities in the design of a system of automatic water level tanks in use at home or in the industry. This system will use ultrasonic sensors, will automatically regulate the filling of water in the water reservoir. This system can also monitor water level heights through the internet on smartphones.

1.2 Research Goal

The purpose of this case study is to make an automatic water level tank system in the industry or at home. and monitor the water lever via an android smartphone.

1.3 Research Benefit

The benefits of this research are:

1. Able to make intelligent systems that are integrated with several important components such as sensors, actuators.
2. Implement an intelligent system unit that can help someone to monitor the water level just thought of Android in a smartphone.
3. Make users easier to control the water level tank automatically.

2. METHOD

In the preparation of this Final Project, several steps are used, namely: observation, literature study, planning, testing, and test results. Observations were made by going directly to the field to get the data needed, the literature was done by looking for books, papers, papers, journals, and articles relating to Wemos D1 R2, Ultrasonic, relays, and how to create applications. The making of this tool is carried out in 2 stages, namely the hardware design stage and the software design stage. The hardware components used are Wemos D1 R2, Ultrasonic sensor, relay module, protoboard, male-male cable, male cable, 12v adapter, and Android smartphone. The software uses IDE Arduino and Blynk app. Following the hardware, circuit scheme is shown in Figure 1.

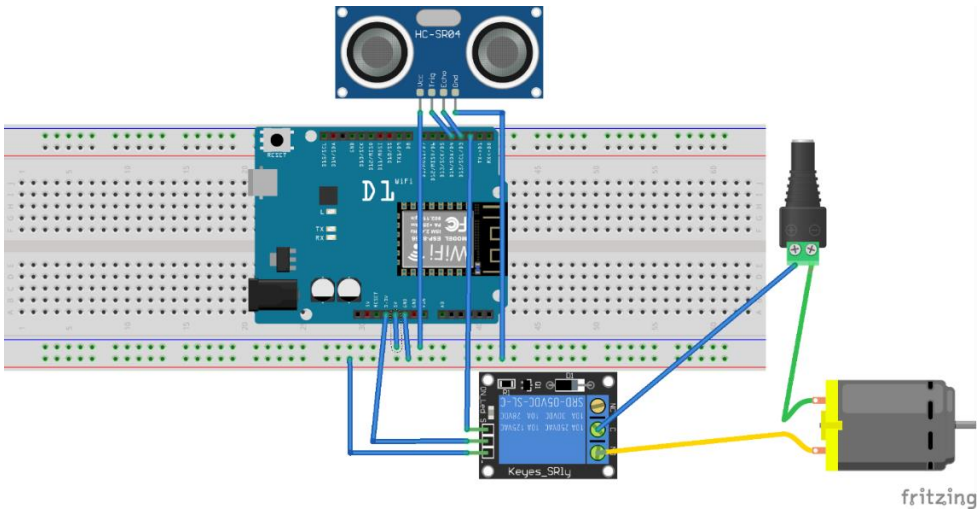

Figure 1. Circuit scheme

In making the processing system tool using wemos d1 r2 as a microcontroller. Wemos D1 R2 specifications have 11 digital input/output pins that can be used as input or output, wemos d1r2 also has all pins having interrupt / PWM / I2C / one-wire supported (except for D0). The micro USB connection, a power jack, 9-24V power input, compatible with Arduino, compatible with nodeMCU. The following is the form of Wemos d1 r2, can be seen in Figure 2.

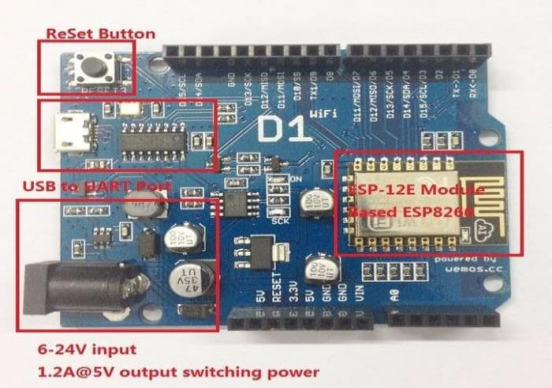

Figure 2. Wemos D1R2

Wemos D1R2 already has ESP-12E module based Esp8266 used as serial communication for data transceivers. ESP-12E is a miniature WI-FI present module in the market The core of ESP-12E is ESP8266ex, which is a high integration of wireless SoC (system on chip). It is a feature that is reliable and has the capability to function as a standard application. It is a low-cost solution for delving IoT applications. ESP-12E module is a wireless communication device that works at a frequency range: 2.412-2.484 GHz and can function as a master or slave. Its baud rate value is 9600. It works at a voltage of 3.3 volts. The maximum current allowed to draw per pin is 15mA. The ESP-12E module has two pins (RST, ADC, EN, GPIO 0-16, VDD, CS0, MISO, MOSI, SCLK, GND, RXD0, TXD0).

In this tool, an ultrasonic sensor is used to measure the water level in the tank. The ultrasonic sensor or commonly called HC-SR04 uses sonar to measure objects as bats do. It offers excellent non-contact range detection with high accuracy and stable package. It comes complete with an ultrasonic transmitter and receiver module. Ultrasonic sensors have ranging distances: 2 cm - 400/1 "- 13 ft.
The following is the form of Ultrasonic sensor, can be seen in Figure 3 and Table 1 is module pin of ultrasonic sensor as well electrical parameters is shown in Table 2.

Figure 3. Ultrasonic sensor

This tool also uses a 5 volt dc songle relay, for the shape can be seen in Figure 4. This relay is used for switches that are connected to the motor. This relay requires a 5v power input. The current that can be handled by Songle relay is a maximum of 7A (at 240 VAC / 28 VDC) to 10A (for AC 125

Volt), meaning that it can be used to control electronic equipment connected to power plant electricity (220 VAC) to more than 1500 Watts.

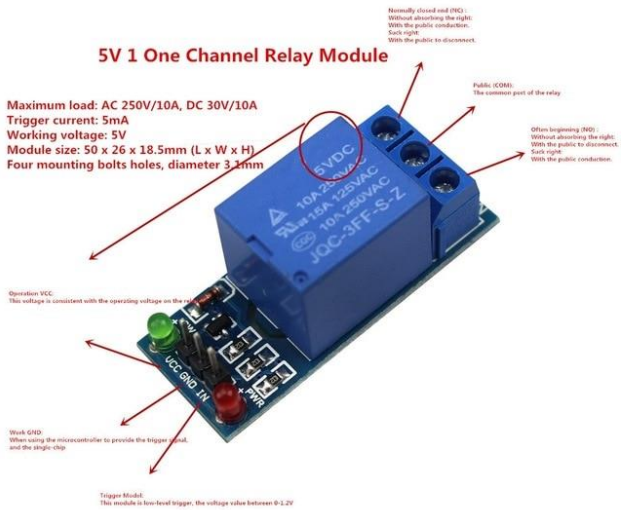

Figure 4. Relay module

Ultrasonic sensor, Wemos D1R2 which has ESP8266 module, relay, and making android applications which are then developed as desired from the working system of the tool. For the flowchart of this tool can be seen in Figure 5.

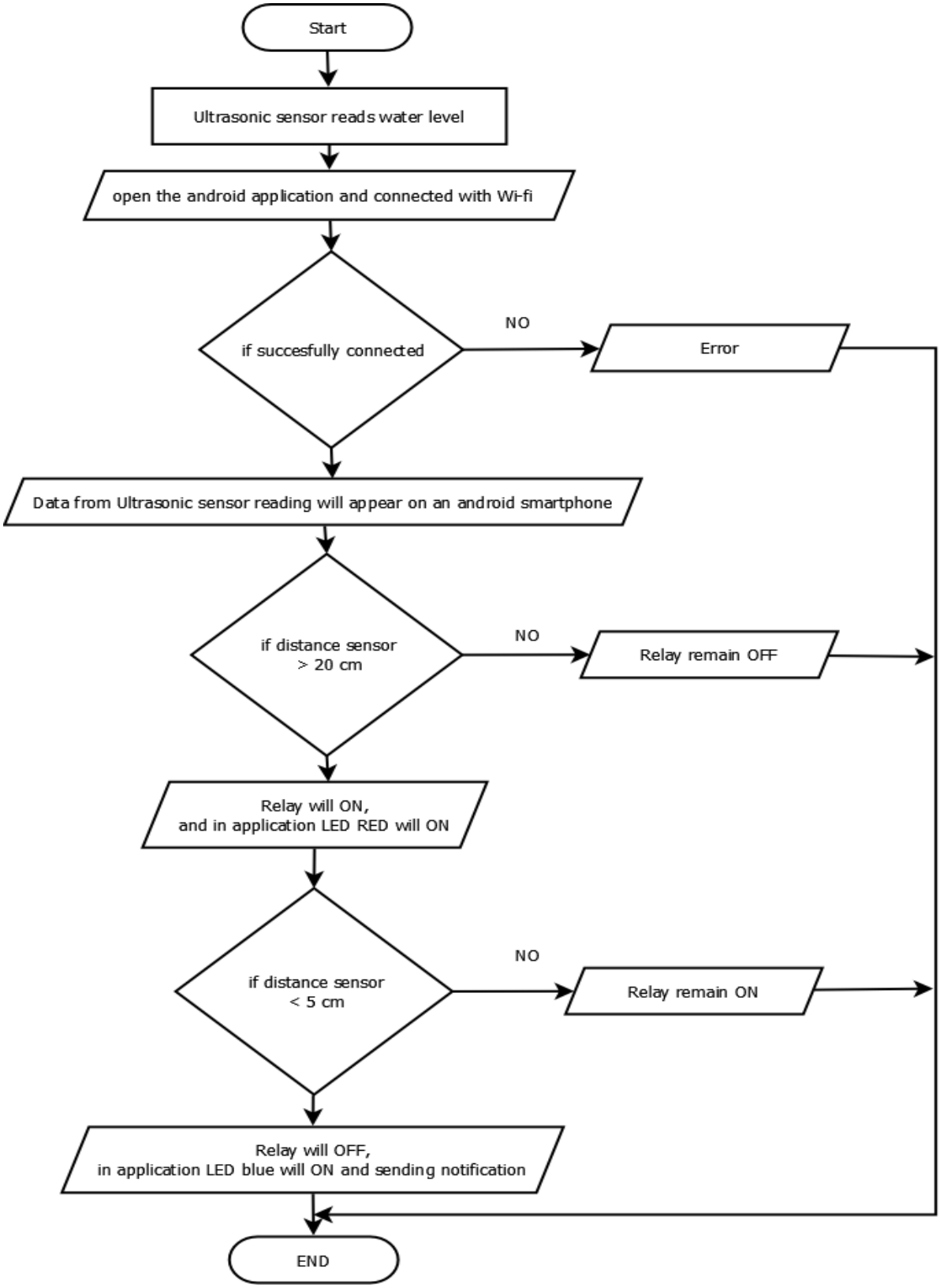

Figure 5. Flowchart

From the flowchart, explaining that the water level tank monitoring system works from the tools used in this study. Starting with an Ultrasonic sensor reading the water level then the user opens

an android application that is connected to a Wi-fi module on Wemos D1 R2. If successful, then the data from the water level reading will be displayed on the Android smartphone. If the water level exceeds 20 cm, the relay will be ON at the same time it will activate the dc motor and if the water level is less than 5cm the relay will be off at the same time it will turn off the dc motor.For Android applications using the Blynk application. First login to the Blynk website and download the Blynk application on android. Then start creating layouts, then use the widget box to make the desired layout. the layout can be seen in Figure 6.

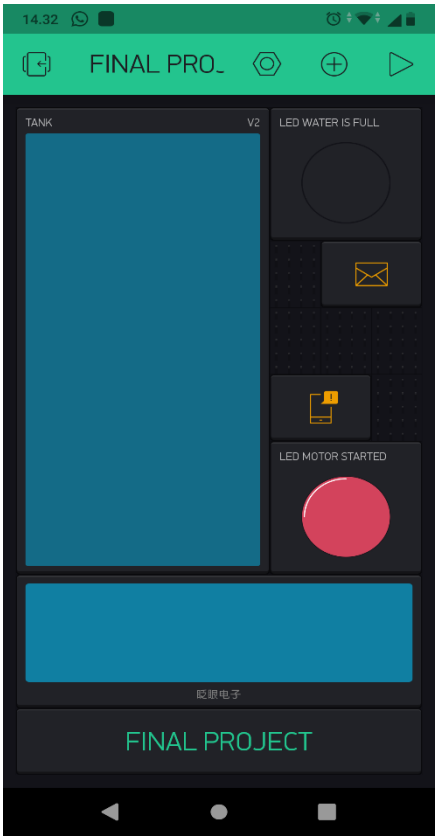

Figure 6. Layout Blynk

In the Layout, there is a start button which later serves to connect with the Wi-fi module. There is a widget box that will display data in the Blynk application. A widget level v box will be used to display the data from the height reading by the Ultrasonic sensor. Widget box LED as an indicator of the on / off state of a dc motor while widget box LCD is used to display the condition of the water tank level. And for the widget box Email and notification is used as a notification of the full water tank condition that will send notifications and emails on the smartphone.

3. RESULT AND ANALYSIS

The results of the physical appearance of the design of this tool can be seen in Figure 7. In the picture shown a wemos d1 r2 is in the box, an Ultrasonic sensor is contained in a water tank. And a relay dc volt 1 channel and dc motor. Furthermore, in the results of the research and testing, evidence was obtained when the tool starts connected to the internet first. When the user opens the Blynk application and starts connecting with ESP-12E module by pressing the start button. If successful then on the smartphone screen will appear the results of water level readings carried out by Ultrasonic sensors. When reading the ultrasonic sensor the height limit is less than 5cm the led on the relay will be off, and the display in the blue Blynk led application will light up. At the same time, there is a notification from the smartphone in the form of notification and Email, the results can be seen in Figure 8. When the Ultrasonic sensor reading exceeds 18 cm, the led on the relay will be on, the display in the red Blynk led application will light up indicating the dc motor is on. the results can be seen in Figure 9.

Figure 7.Tools of project

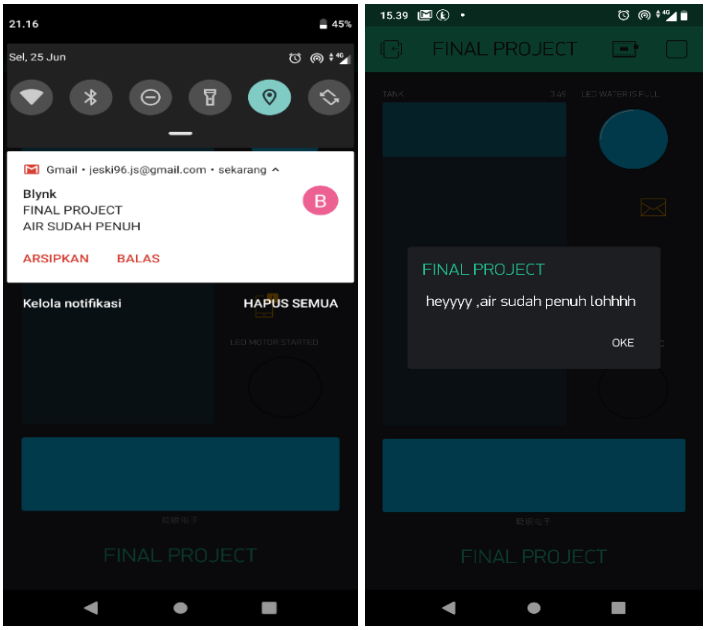

Figure 8. Notification and Gmail

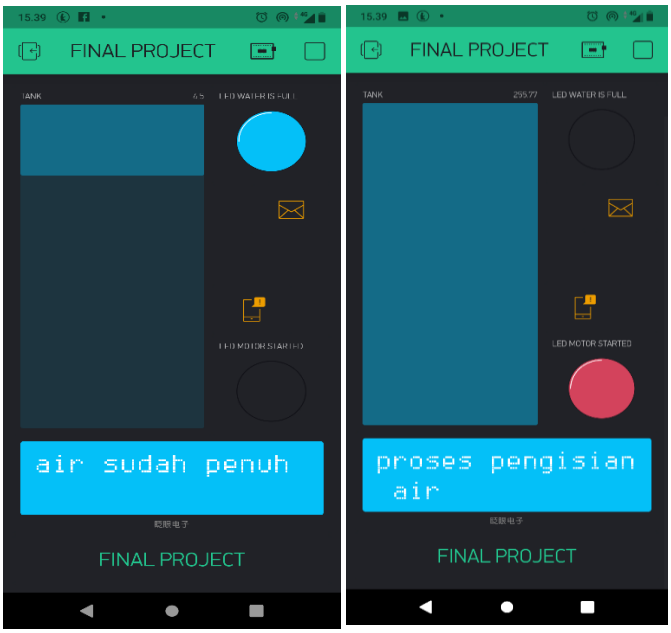

Figure 9. Water filling process

In Table 1 an ultrasonic sensor is tested, to measure the water level, in this table shows the comparison of actual distance measurements without sensors and using sensors. From ten experiments with different distances, the average error was 0.2 cm. With the total actual distance of 550 cm and the total distance that the sensor is 552.09, the percentage of error is 0.38%.

Table 1. Range Measurements and corresponding errors

NO	Actual Distance (cm)	Measure Distance (cm)	Deviation
1	10	10,12	0,12
2	20	20,17	0,17
3	30	30,22	0,22
4	40	40,27	0,27
5	50	50,27	0,27
6	60	60,22	0,22
7	70	70,41	0,41
8	80	80,22	0,22
9	90	90,05	0,05
10	100	100,14	0,14
TOTAL	550	552,09	2,09

*cm – Centimeter

In Table 2 Testing the water filling system in the tube, with the results obtained is when the ultrasonic sensor reading is less than or equal to 5 cm and the water level is saved 22 cm then the dc motor condition will die. When the ultrasonic sensor reading is more than 20 cm and the water level in a 2 cm tube the dc motor condition will turn on.

Table 2.Water filling system testing

Tube height (cm)	Distance sensor (cm)	High water (cm)	Motor condition
22	2	22	OFF
22	5	20	OFF
22	8	18	OFF/ON
22	10	14	OFF/ON
22	13	12	OFF/ON
22	15	10	OFF/ON
22	18	8	OFF/ON
22	20	5	ON
22	22	2	ON

4. CLOSING

From the results of the above tests, it can be concluded that monitoring water level with an ultrasonic sensor using the wemos d1 r2 microcontroller. wirelessly connected via the ESP-12E module and integrated with this android works well according to the design and desired. This tool can be monitored remotely but must be connected to Wi-fi (internet). Sensitivity and accuracy of Ultrasonic sensors when detecting water levels quite quickly depending on the distance of the sensor affected by the reflection of the sonar. on the Blynk application, it is very easy to create and display the value of detecting ultrasonic sensors. Suggestions if development is carried out in this study, it is better to use sensors that have more accuracy in detecting water levels.

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